PEACE/WILLISTON
FISH & WILDLIFE
COMPENSATION
PROGRAM

BC hydro

BRITISH
COLUMBIA

# A Reconnaissance Survey of Unnamed Lake (Apostrophe Lake)

M. J. Hunter
March 1997

PWFWCP Report No. 148

The Peace/Williston Fish & Wildlife Compensation Program is a cooperative venture of BC Hydro and the provincial fish and wildlife management agencies, supported by funding from BC Hydro. The Program was established to enhance and protect fish and wildlife resources affected by the construction of the W.A.C. Bennett and Peace Canyon dams on the Peace River, and the subsequent creation of the Williston and Dinosaur Reservoirs.

**Peace/Williston Fish and Wildlife Compensation Program, 1011 Fourth Ave. 3rd Floor, Prince George B.C. V2L 3H9**

Website: *www.bchydro.bc.ca/environment/initiatives/pwcp/*

This report has been approved by the Peace/Williston Fish and Wildlife Compensation Program Fish Technical Committee.

Citation: M. J. Hunter. March 1997. A reconnaissance survey of Unnamed Lake (Apostrophe Lake). Peace/Williston Fish and Wildlife Compensation Program, Report No. 148. 26pp plus appendices.

Author(s): Mark J. Hunter[1]
Address(es): [1] Peace/Williston Fish and Wildlife Compensation Program, 1011 Fourth Ave., 3rd Floor Prince George, B.C. V2L 3H9

105-02888/

# A RECONNAISSANCE SURVEY OF

# UNNAMED LAKE (APOSTROPHE LAKE)

| | |
|---|---|
| WATERSHED: | Williston Reservoir (Parsnip Reach) |
| DATE OF SURVEY: | July 18 -19,1996 |
| FIELD CREW LEADER: | Mark Hunter |
| FIELD ASSISTANT: | Karin Mathias |
| REPORT PREPARED BY: | Mark Hunter |

BRITISH COLUMBIA CONSERVATION FOUNDATION

PEACE / WILLISTON FISH AND WILDLIFE COMPENSATION PROGRAM

B. C. MINISTRY OF ENVIRONMENT, LANDS AND PARKS

FUNDED BY: FOREST RENEWAL BRITISH COLUMBIA

RELEASED BY: _____

D. J. Cadden, Regional Fisheries Biologist

**LAKE: Unnamed (Apostrophe Lake)** **SYSTEM NAME: Nation River**

**A.S.A.P. REFERENCE NO.:** **WATERSHED CODE: 237-6750**

**DATA ON FILE FOR THIS SURVEY**

| | | | |
|---|---|---|---|
| Location | X | Dissolved 02 / Temp. Profiles | X |
| Physical Data | X | Winter Dissolved 02 / Temp. Profiles | -- |
| Bench Mark | X | Netting Record | X |
| Terrain Features | X | Lake Catch Summary | X |
| Access | X | Individual Fish Data | X |
| Resorts and Campsites | X | Fish Preserved | -- |
| Other Developments | X | Stomach Analysis | X |
| Obstructions and Pollutions | X | Scale Reading | X |
| Special Restrictions | X | Location of Inventory Sites | X |
| Aquatic Plants | X | Photograph Directory | X |
| Wildlife Observations | X | Appendices | |
| Miscellaneous Comments | X | A: Water Chemistry Analysis | X |
| Lake Drainage | X | B: Tributary Stream Data | X |
| Fisheries Management Comments | X | C: Fish Scale Analysis | X |
| History of Previous Surveys | X | Bathymetric Map Reduction | X |
| Water Chemistry Summary | X | Bathymetric Map | -- |

**LOCATION**

Location: approximately 139 km west of Mackenzie

| | | | |
|---|---|---|---|
| Elevation: | 925 m ± 25 m | U.T.M.: | 10.355714.6124262 |
| Latitude / Longitude: | 55°14'37" 125°16'10" | N.T.S. Map No.: | 93 - N / 3 & N / 6 |
| Management Unit: | 7-28 | Biogeoclimatic Zone: | Sub - Boreal Spruce |
| Ecoprovince: | Sub - Boreal Interior | Ecoregion: | Fraser Basin |
| Ecosection: | Babine Uplands | | |

Drainage: Unnamed C. --> Unnamed L. --> Unnamed C. --> Tchentlo L. --> Nation R. Chuchi L. --> Nation R. --> Williston Reservoir (Parsnip Reach - Nation Arm) --> Peace R.

**PHYSICAL DATA**

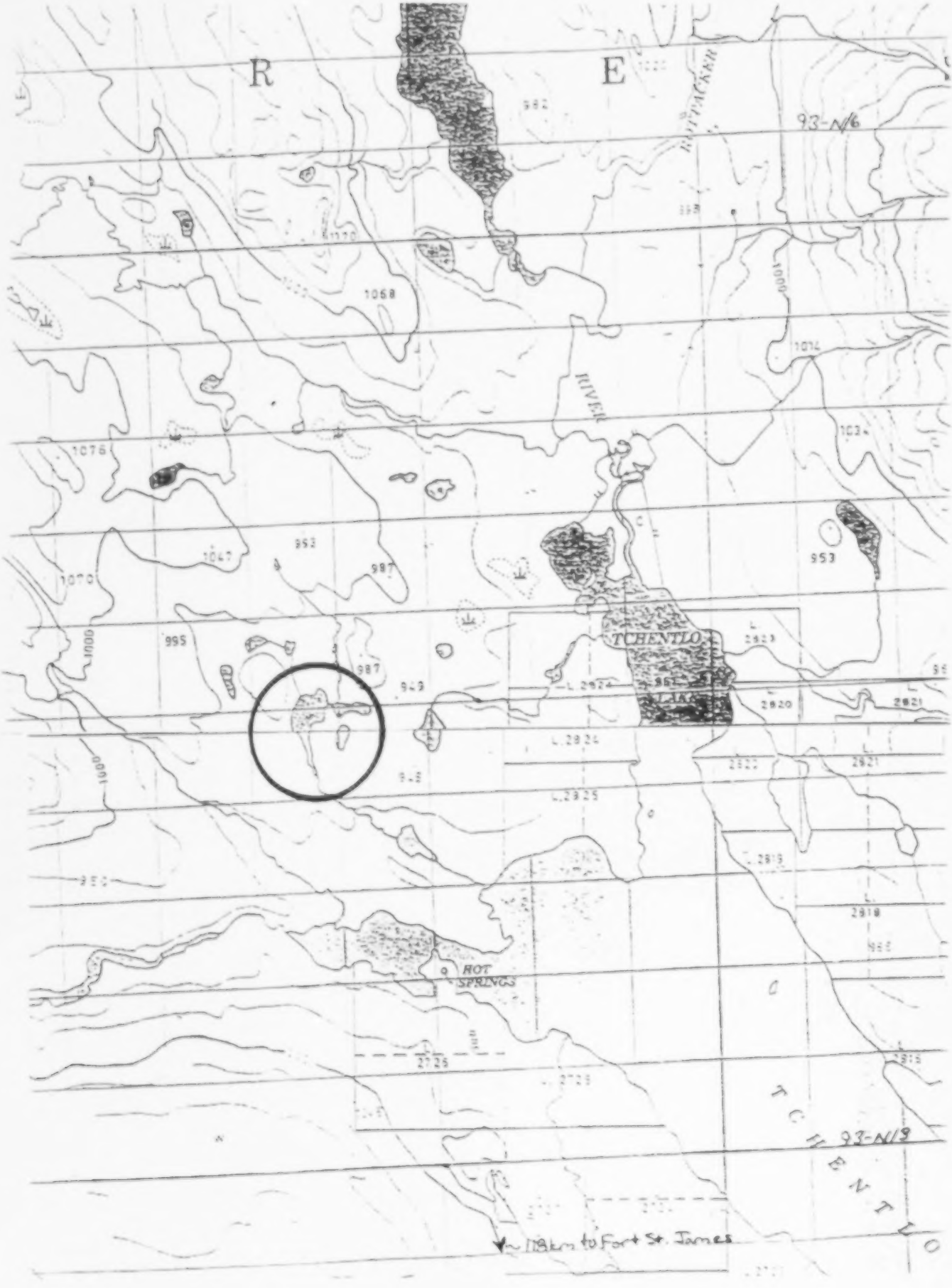
| | | | |
|---|---|---|---|
| Lake Drainage Area: | 5.1 $km^2$ | Volume: | 294 162$m^3$ |
| Water Surface Area: | 180 989 $m^2$ | Perimeter of Islands: | 0 m |
| Area Above 6 m Contour: | 180 989 $m^2$ | Number of Islands: | 0 |
| Shoreline Perimeter: | 2 652 m | Mean Depth: | 1.7 m |
| Maximum Depth: | 6.5 m | Secchi Reading: | 4.4 m |
| Filterable Residue (TDS): | 120 mg/L | | |

Sounding Device: Lowrance X-15 Elevation Source: Contour Interpolation

**BENCHMARK**

(Iron spike, center of red circle) located 2.0 m above present water level in a 26 cm diameter spruce tree that is 2.72 m from the present lake's edge and located on the northeast side of the lake opposite from a large boulder that is approximately 150 m east of Inlet # 3 (Plate # 3).

High Water Mark: 0.3 m above water level at time of survey


R
E
93-N/6
TCHENTLO
LAKE
HOT
SPRINGS
93-N/9
~ 118km to Fort St. James

**LAKE: Unnamed Lake (Apostrophe Lake)**

**TERRAIN FEATURES**

**Immediate Shoreline:**

Apostrophe Lake is fronted on the east by a moderately thick growth of alders and willows with some sedgegrasses growing on a low slope, and on the west side of the lake by the same growth on a moderately steep slope. Three swamps, one in the northwest corner and two in the northeast corners of the lake are dominated by sedgegrasses with alders and willows growing behind on a low slope. The south end of the lake is fronted by a sedge grass growth with alders and willows behind; the land slopes away at a moderately steep slope. A large beaver dam, heavily overgrown by alders, is located at the lake's edge at the mouth of the outlet creek. Behind the alders and willows grows a mature forest of lodgepole pine and spruce trees.

The lake's bottom drops off slowly towards the middle of Apostrophe Lake. Along the east and west sides of Apostrophe Lake, the shoreline substrate is comprised of a thin layer of silts over sands, gravels and cobbles with an occasional boulder. The shoreline substrate in the northwest corner of the lake is dominated by sands overgrown by pondweeds. In the northeast corner of the lake, silts and organics make up the lake's bottom. The southeast and southwest sides of the lake are dominated by silts and organics, with the south shore in front of the beaver dam on the outlet creek being silts over gravels. There is some large woody debris along the entire shoreline of Apostrophe Lake, with the majority of it being located near the beaver dam on the outlet creek at the south end of the lake.

**Surrounding Country:**

Apostrophe Lake is surrounded by gently rolling hills that supports a mature forest of lodgepole pine and spruce trees with some fir and deciduous trees in small quantities. The Tchentlo Forest Service Road runs east - west approximately 40 m to the south of the lake. (forest service roads to the south and west). Apostrophe Lake is situated within the Sub-Boreal Spruce biogeoclimatic zone.

**LAKE: Unnamed Lake (Apostrophe Lake)**

## ACCESS

**Directions:**

From the junction of Highway 27, the Teardrop Forest Service Road and the Germansen Landing North Road, follow the Teardrop Forest Service road west for approximately 40 km. Turn right on to the Leo Creek Forest Service Road and proceed for approximately 68 km to where the Driftwood Forest Service Road breaks off. Turn right on to the Driftwood Forest Service Road and drive for approximately 16 km, then turn right on to the Tchentlo Forest Service Road. Drive for approximately 5.6 km, then turn left on to an unnamed road (Albert Lake Mining Road). Unnamed Lake is located on the east (right) side, in the corner between the Tchentlo Forest Service Road and the unnamed road (Albert Lake Mining Road).

**Road Type and Conditions:**

All four of the Forest Service Roads are well- maintained, two-lane gravel roads that can be easily traveled in a two-wheel drive vehicle during the summer. The unnamed road (Albert Lake Mining Road) is a well-maintained, one-lane gravel road that can be traveled in a two-wheel drive vehicle during the summer.

**Restrictions:**

None known.

## RESORTS AND CAMPSITES

In the southwest corner of Apostrophe Lake, a campsite has been built that includes a small table and a cross-pole for hanging a tarp or for cleaning large game during the hunting season.

## OTHER DEVELOPMENTS

An old, broken canoe was found on the shore of the west side of Apostrophe Lake.

## OBSTRUCTIONS AND POLLUTIONS

None.

**LAKE: Unnamed Lake (Apostrophe Lake)**

## SPECIAL RESTRICTIONS

None known.

## AQUATIC PLANTS

The following aquatic plants were identified at the time of survey:

marestail (Hippuris sp.)

Equisetum sp.

claspingleaf pondweed (Potamogeton richardsonii)

## WILDLIFE OBSERVATIONS

The following wildlife or signs were identified during the time of survey:

1 squirrel

moose tracks and droppings

songbirds

## MISCELLANEOUS COMMENTS

1) There is easy access to the lake from the unnamed road (Albert Lake Mining Road) that runs along the west side of the lake.

2) A culvert should be placed under the unnamed road (Albert Lake Mining Road) where Inlet # 4 is fed by seepage under the road to provide better drainage for the west side of the road. This would prevent siltation from occurring in such large quantities into Apostrophe Lake. This would also prevent future damage to the road itself due to subsurface flows.

3) Bathymetric map: The lake outline is drawn from an enlargement of air photo BCB 90121: No. 055, flown July 25, 1990.

**LAKE: Unnamed Lake (Apostrophe Lake)**

**LAKE DRAINAGE**

**General:**

Apostrophe Lake is fed by four small creeks, one of which flows intermittently. The outlet drains the lake to the south, through an unnamed lake, to empty into Tchentlo Lake, which is located approximately 2.0 km downstream of Apostrophe Lake. Tchentlo Lake is drained to the east by the Nation River.

**Major Systems:**

There are no major systems.

**Minor Systems:**

Inlet # 1 - Unnamed Creek

The first 25 m of Inlet # 1 upstream of Apostrophe Lake flows through the swamp located in the northwest corner of the lake (Plate # 4). The channel is partly contained by sedge grasses, alders and willows, with the substrate being comprised of silts and organics. The average wetted width and depth is 2.0 m and 0.5 m respectively. Over the next 25 m of the creek, the substrate changes to fines and gravels. The wetted width over this portion of the creek at the time survey averages 2.0 m with a depth of 0.45 m. Above 50 m upstream of the lake, the average wetted width of 1.25 m narrows and the depth decreases. Patches of gravels offer some spawning habitat. Moss covered banks with some alders and other vegetation contain the creek channel.

A Stream Survey card was completed for a sample site located approximately 150 m upstream of Apostrophe Lake (Plates # 5 & # 6). The average wetted width is 1.5 m and the average maximum riffle depth is 0.2 m. The substrate is composed of gravels (45%), fines (40%) and cobbles (15%). The creek morphology is mainly riffles (50%) and runs (45%) with a gradient of 5%. The water temperature at the time of the survey was 14 °C. For additional information, refer to Appendix B.

Inlet # 2 - Unnamed Creek

Inlet # 2 drains into Apostrophe Lake from the north in the northeast corner of the lake. There are two beaver dams located approximately 40 m and 90 m upstream of the lake. These dams are 0.4 m high and 1.0 m high respectively. The channel has an average wetted width of 0.5 m and depth of 0.1 m. The substrate for the first 70 m is mainly organics, with the substrate changing to fines and woody debris further upstream. The banks are covered by mosses and grasses. Numerous side channels drain the surrounding

marsh and enter Inlet # 2 along its entire length. Inlet # 2 offered no fisheries potential during the survey period.

Inlet # 3 - Unnamed Creek

Inlet # 3 enters Apostrophe Lake from the east in the northeast corner of the lake (Plate # 7). Over the first 40 m of Inlet # 3, the average wetted width and depth are 1.0 m and 0.15 m respectively. The creek flows through a channel choked by alders and willows, and over numerous small beaver dams (0.1 m to 0.3 m in height). Approximately 40 m upstream of Apostrophe Lake, there is a 1.0 m high and 30.0 m long beaver dam. This dam was probably not passable to upstream moving fish at the time of survey due to the small amount of water that flowed over the top of the dam. A large pond is located on the upstream side of the dam that is approximately 250 m long and 90.0 m wide. Inlet # 3 had no fisheries potential during the survey period.

Inlet # 4 - Unnamed Creek

Inlet # 4 enters Apostrophe Lake on the west side of the lake. The creek has an average wetted width of 1.5 m and depth of 0.15 m, and flows through a moss covered channel. Approximately 35 m upstream of the lake, at the road, the channel goes underground. Although no culvert is present, there is some flow coming from under the road bed. Inlet # 4 had no fisheries potential during the survey period.

Outlet - Unnamed Creek

The lake is drained over a 1.15 m high and 16.0 m long beaver dam located at the south end of Apostrophe Lake (Plates # 8 & # 9). A second beaver dam, 0.6 m high and 9.0 m long, is located approximately 10 m downstream of Apostrophe Lake. Upstream fish passage was probably hindered, if at all possible, over these dams at the time of survey due to low flows over the tops of the dams. These two dams, and the area in between them, are heavily overgrown by alders and willows. Gravels and fines are located directly downstream of both dams. Approximately 15 m downstream of the lake, there are two debris jams, each 0.02 m high, that have water flowing freely over their tops. The lower debris jam is partially blown out. Downstream of the debris jams, the banks change from being dominated by alders and willows to being only choked by sedge grasses growing right in the channel from approximately 25 m to 35 m downstream of Apostrophe Lake. Approximately 40 m downstream of the lake, the creek flows through a 36 inch culvert under the Tchentlo Forest Service Road. Downstream of the culvert, the channel becomes more and more confined by the steep sides of a small valley (approximately 20.0 m deep). The substrate is dominated by cobbles directly downstream of the culvert - the Tchentlo Forest Service Road is probably the source of this cobble. Approximately 10 m downstream of the culvert, the substrate returns to being dominated by gravels and fines. Further downstream, the substrate changes to include cobbles and some boulders which create some small cascades. Fallen trees and other woody debris create frequent jams that may hinder fish passage in both directions.

**LAKE: Unnamed Lake (Apostrophe Lake)**

A Stream Survey card was completed for a sample site located approximately 85 m downstream of the lake (Plates # 10 & #11). The average wetted width is 1.7 m and average maximum riffle depth is 0.18 m. The substrate is mainly gravels (50%) and fines (50%) and offers some spawning habitat. The creek morphology consists of runs (60%) and riffles (30%) with a gradient of 2.5%. The water temperature was 14 °C at the time of the survey. During the time of survey, 5 small rainbow trout fry were seen. For additional information, refer to Appendix B.

A second Stream Survey card was completed for a sample site located approximately 135 m downstream of the lake (Plates # 12 & # 13). The average wetted width is 0.18 m and the average maximum riffle depth is 0.2 m deep. The substrate changes to gravels (40%), fines (40%), cobbles (15%) and boulders (5%). The creek morphology also changes to being mainly riffles (50%) and runs (40%) with a gradient of 4.0%. For additional information, refer to Appendix B.

**LAKE: Unnamed Lake (Apostrophe Lake)**

## FISHERIES MANAGEMENT COMMENTS

Apostrophe Lake supports a good population of rainbow trout. However, this lake should be managed as a low to medium use fishery because of the small size and shallow depth of the lake. Better access to the spawning habitat in the outlet creek could be provided by lowering a partial section of the large beaver dam located at the mouth to the outlet creek. However, this is probably not necessary to maintain the present population of rainbow trout in the lake. Both dissolved oxygen levels and pH are at appropriate levels to sustain a fish population.

## HISTORY OF PREVIOUS SURVEYS

**Lake Surveys:**

None known.

**Other Related Studies:**

None known.

**LAKE: Unnamed Lake (Apostrophe Lake)**

**WATER CHEMISTRY SUMMARY** **Limnology Station No. 1**

**Field Conditions:**

| | | | |
|---|---|---|---|
| Date: | July 19, 1996 | | |
| Time: | 1155 hrs | Air Temperature: | 9 °C |
| Wind Velocity: | 5 - 10 km/h | Wind Direction: | from the S |
| Cloud Cover: | 10 / 10 o.c. | Surface Conditions: | small waves |
| Secchi Disc: | 4.4 m | Water Colour: | clear with yellowish tinge |

**Method Used:**

| | |
|---|---|
| Dissolved Oxygen: | YSI Model 57 Oxygen / Temperature Meter |
| Water Temperature: | YSI Model 57 Oxygen / Temperature Meter |
| Air Temperature: | Hand-Held Alcohol Thermometer |
| pH (field): | Digital pH Pocket Tester |
| H2S (field): | Hach H2S Field Test Kit |
| Laboratory Used: | Pacific Environmental Science Center |
| Water Sampler: | Vertical Alpha Water Bottle (Vandorn) |
| Metal Sampler: | By Hand; Preserved With 2.0 mL Nitric Acid |
| Substrate Sampler: | Substrate Sample Not Taken |

**Water Sample Chemistry:** **SEAM Site No.:** E 223179

| | Sampling Depths | |
|---|---|---|
| | Surface (0.5 m) | Lower (4.5 m) |
| Alkalinity (lab) | 110 mg / L | 110 mg / L |
| Filterable Residue 105°C (lab) | 120 mg / L | 120 mg / L |
| H2S (field) | N/A | 0 mg / L |
| Nitrogen - Total (lab) | 0.26 mg / L | 0.23mg / L |
| Non-Filterable Residue (lab) | < 5 mg / L | < 5 mg / L |
| pH (field) | 8.8 | 8.7 |
| pH (lab) | 8.26 | 8.27 |
| Phosphorus - Total Dissolved (lab) | 0.005 mg / L | 0.003 mg / L |
| Specific Conductance (lab) | 199 µS / cm | 199 µS / cm |

Bottom Depth: 6.5 m

Substrate Sample Depth: N/A

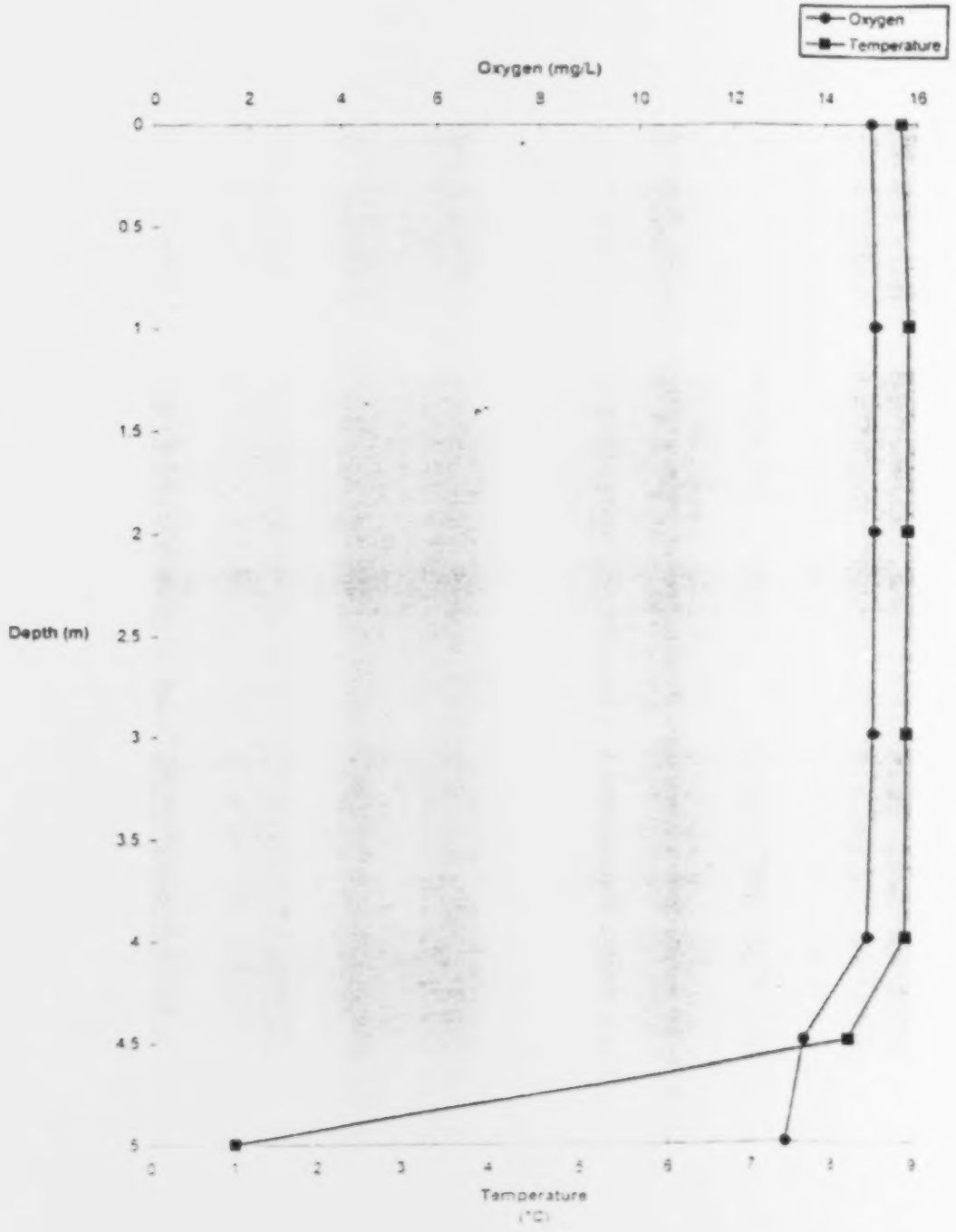
**LAKE: Unnamed Lake (Apostrophe Lake)**

**SUMMER OXYGEN / TEMPERATURE DATA**

| DEPTH (m) | 02 (mg/L) | TEMPERATURE (°C) |
|---|---|---|
| Surface | 15.0 | 8.8 |
| 1.0 | 15.1 | 8.9 |
| 2.0 | 15.1 | 8.9 |
| 3.0 | 15.1 | 8.9 |
| 4.0 | 15.0 | 8.9 |
| 4.5 | 13.6 | 18.2 |
| 5.0 | 13.2 | 1.0 |
| 6.5 | Bottom* | |

* There is a thick (approx. 1.5 m) layer of suspended organics and sediments from 5.0 m down to the lake's bottom.

## SUMMER OXYGEN / TEMPERATURE PROFILE



**LAKE: Unnamed Lake (Apostrophe Lake)**

**NETTING RECORD**

Mesh Size Experimental Order: 25, 76, 51, 89, 38, 64 mm

NETTING SITE # 1

| | | | | |
|---|---|---|---|---|
| Type: | Sinking Monofilament Gill Net | | | |
| Date Set: | July 18, 1996 | | Time: | 1540 hrs |
| Date Lifted: | July 18, 1996 | | Time: | 1940 hrs |
| Net Dimensions: | Length: | 91.4 m | Depth: | 2.4 m |
| Shallow End Mesh Size: | 25 mm | | Depth: | 1.5 m |
| | | | Substrate: | silt over cobble |
| Deep End Mesh Size: | 64 mm | | Depth: | 4.0 m |
| | | | Substrate: | silt / organics |

Comments:

**LAKE CATCH SUMMARY**

| Species | Netting Site No. 1 | Angled | Other | Total | Number Sampled | Number Preserved | Size Range (cm) |
|---|---|---|---|---|---|---|---|
| **RB** | 58 | 0 | 0 | 58 | 30 | 0 | 12.7-27.4 |
| **WS** | 2 | 0 | 0 | 2 | 0 | 0 | 10.1 - 23.5 |

**Minnow Traps:**

**Bait:** Sardines

| Trap No. | Hours | Depth (m) | Substrate | Species | No. Caught | Size Range (cm) |
|---|---|---|---|---|---|---|
| 1 | 4:49 | 0.8 | silt / organics | LKC | 71 | 5.4-9.7 |
| 2 | 4:49 | 0.7 | fines and waterweed | LKC<br>WS | 131<br>4 | 4.8-10.5<br>10.9-13.1 |
| 3 | 4:53 | 1.0 | cobble / gravel | LKC<br>WS<br>CC | 38<br>3<br>1 | 5.2-11.0<br>10.6-10.8<br>7.3 |
| 4 | 4:52 | 1.3 | silt over gravel | LKC | 35 | 5.6-9.5 |

**LAKE: Unnamed Lake (Apostrophe Lake)**

## INDIVIDUAL FISH DATA

**Date Captured:** July 18, 1996

**Method:** Sinking Monofilament Gillnet

**M - Male**
**F - Female**
**? - Not Obvious**

**IMM - Immature**
**MG - Maturing**
**MT - Mature**
**GV - Gravid**
**SP - Spent**
**? - Not Obvious**

**EG - Egg**
**FR - Fin Ray**
**HD - Head**
**ML - Milt**
**OT - Otolith**
**SC - Scale**

| Species | Fork Length (cm) | Weight (grams) | Sex | Gonadal Maturity | Sample Type | Age (yr) | Stomach Contents | | | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Plankton | Insects | Fish | Other | |
| RB | 23.4 | 136 | M | Imm | SC | 3+ | Da | Cr | | | |
| RB | 20.6 | 97 | F | Imm | SC | 2+ | Da | Cr | | | |
| RB | 14.3 | 25 | F | Imm | SC | 2+ | | Cr | | | |
| RB | 20.5 | 90 | M | Imm | SC | 3+ | | Cr, B | | | |
| RB | 24.0 | 134 | F | MG | SC | 3+ | Da | Cr | | | |
| RB | 13.4 | 23 | F | Imm | SC | 1+ | Da | Cr, Ant | | | |
| RB | 13.8 | 27 | M | Imm | SC | 2+ | Da | Cr | | | |
| RB | 25.2 | 153 | M | MG | SC | ** | Da | Cr | | | |
| RB | 24.4 | 146 | F | MG | SC | 2+ | Da | Cr | | | |
| RB | 19.7 | 77 | M | Imm | SC | 3+ | | Cr | | | |
| RB | 12.1 | 28 | F | Imm | SC | 1+ | Da | Cr | | | |
| RB | 25.7 | 154 | F | MG | SC | 4+ | | Cr | | | |
| RB | 22.1 | 120 | F | MG | SC | 3+ | | Cr | | | |
| RB | 23.1 | 132 | F | Imm | SC | 2+ | Da | Cr | | | |
| RB | 12.7 | 19 | M | Imm | SC | 1+ | Da | Cr | | | |
| RB | 19.8 | 91 | F | Imm | SC | 2+ | Da | Cr | | | TW in body cavity |
| RB | 20.6 | 95 | M | MG | SC | 4+ | Da | Cr | | | |
| RB | 14.7 | 26 | F | Imm | SC | 2+ | Da | Cr, B | | | |
| RB | 23.2 | 128 | M | Imm | SC | 3+ | Da | Cr | | | |
| RB | 23.0 | 119 | F | MG | SC | 3+ | Da | Cr | | | |
| RB | 14.2 | 29 | M | Imm | SC | 2+ | Da | | | | |
| RB | 21.0 | 111 | F | MG | SC | 2+ | Da | | | | |
| RB | 27.4 | 181 | F | MG | SC | 4+ | Da | | | | |
| RB | 25.5 | 151 | M | Imm | SC | 2+ | Da | | | | |
| RB | 24.5 | 150 | F | MG | SC | 2+ | | Cr | | | |
| RB | 25.6 | 152 | F | Imm | SC | 3+ | Da | Cr | | | |
| RB | 24.8 | 151 | F | MG | SC | 2+ | Da | | | | |
| RB | 24.6 | 151 | F | MG | SC | 3+ | Da | Cr | | | |
| RB | 13.8 | 23 | M | Imm | SC | 2+ | Da | Cr | | | |
| RB | 23.9 | 138 | F | MG | SC | 3+ | Da | | | | |

B - Beetle
C - Clams
CF - Caddis Fly
Ch - Chaoborus
Cr - Chironomids
Da - *Daphnia*
Di - Diptera
G - *Gammerus*
L - Leech
Li - Lice
O - Organics
S - Snails
St - Stomach
TW - Tape Worm
WB - Water Boatman
WF - Whole Fish

** scale had regenerated - not able to age

LS 1
NS 1
Benchmark
Stream Number And Direction Of Flow
Net Set Number And Site
NS 1
LS 1
Limnostation Number And Site
Plate Number And Direction Of Photograph

**LAKE: Unnamed Lake (Apostrophe Lake)**

**PHOTOGRAPH DIRECTORY**

| Plate | Roll : Number | Description |
|---|---|---|
| 1 | 9: 7 - 9 | Panoramic view of Unnamed Lake (Apostrophe Lake) looking north from the center of the lake. |
| 2 | 9: 5 - 6 | Panoramic view of Unnamed Lake (Apostrophe Lake) looking south from the center of the lake. |
| 3 | 9: 10 | View of the benchmark located 2.0 m above present water level in a 26 cm diameter spruce tree that is 2.72 m from the present lake's edge and located on the northeast side of the lake directly opposite from a large boulder that is approximately 150 m east of Inlet # 3. |
| 4 | 9: 21 | View of the mouth of Inlet # 1 where it enters Unnamed Lake # 2 in the northwest corner of the lake. |
| 5 | 9: 22 | Upstream view of the sample site on Inlet # 1, taken approximately 150 m upstream of Unnamed Lake (Apostrophe Lake). |
| 6 | 9: 23 | Downstream view of the sample site on Inlet # 1, taken approximately 170 m upstream of Unnamed Lake (Apostrophe Lake). |
| 7 | 9: 19 | View of the mouth of Inlet # 3 where it enters Unnamed Lake # 2 in the northeast corner of the lake. |
| 8 | 9: 11 | View of the mouth of the outlet where it drains Unnamed Lake (Apostrophe Lake) from the south end of the lake. |
| 9 | 9:17 | Upstream view of beaver dam # 1 on the outlet, located at the lake's edge. Dam height is 1.15 m. |
| 10 | 9: 12 | Upstream view of sample site # 1 on the outlet, taken approximately 95 m downstream of Unnamed Lake (Apostrophe Lake). |
| 11 | 9: 13 | Downstream view of sample site # 1 on the outlet, taken approximately 75 m downstream of Unnamed Lake (Apostrophe Lake). |

**LAKE: Unnamed Lake (Apostrophe Lake)**

| | | |
|---|---|---|
| 12 | 9: 15 | Upstream view of sample site # 2 on the outlet, taken approximately 145 m downstream of Unnamed Lake (Apostrophe Lake). |
| 13 | 9: 14 | Downstream view of sample site # 2 on the outlet, taken approximately 135 m downstream of Unnamed Lake (Apostrophe Lake). |

LAKE: Unnamed Lake (Apostrophe Lake)

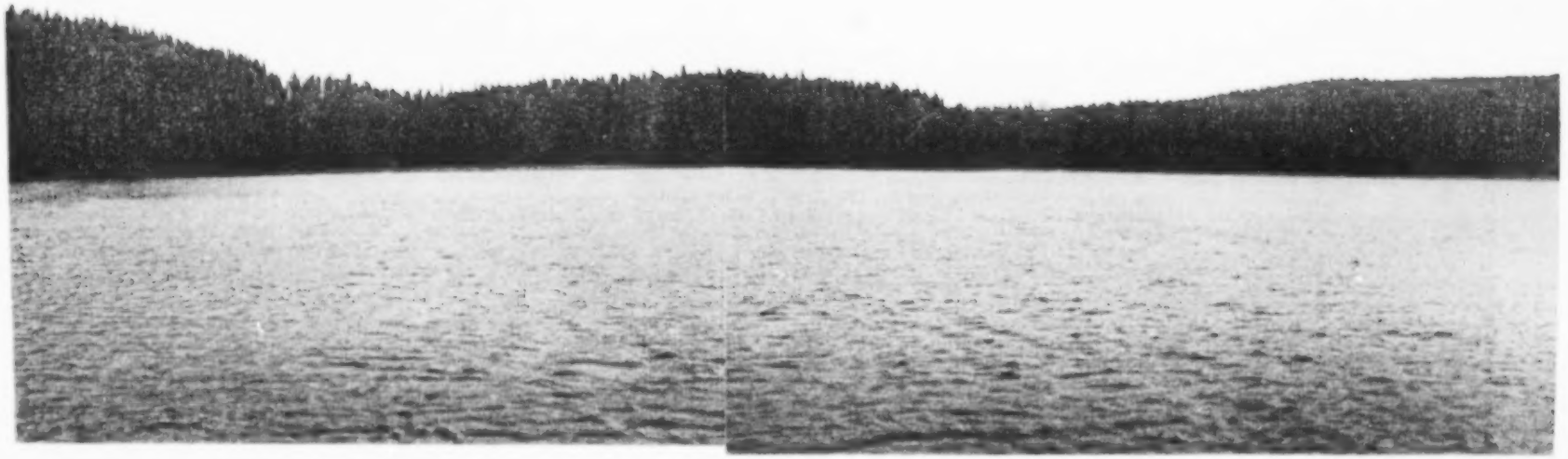


**Plate # 1:** Panoramic view of Unnamed Lake (Apostrophe Lake) looking north from the center of the lake.

LAKE: Unnamed Lake (Apostrophe Lake)

**Plate # 2:** Panoramic view of Unnamed Lake (Apostrophe Lake) looking south from the center of the lake.

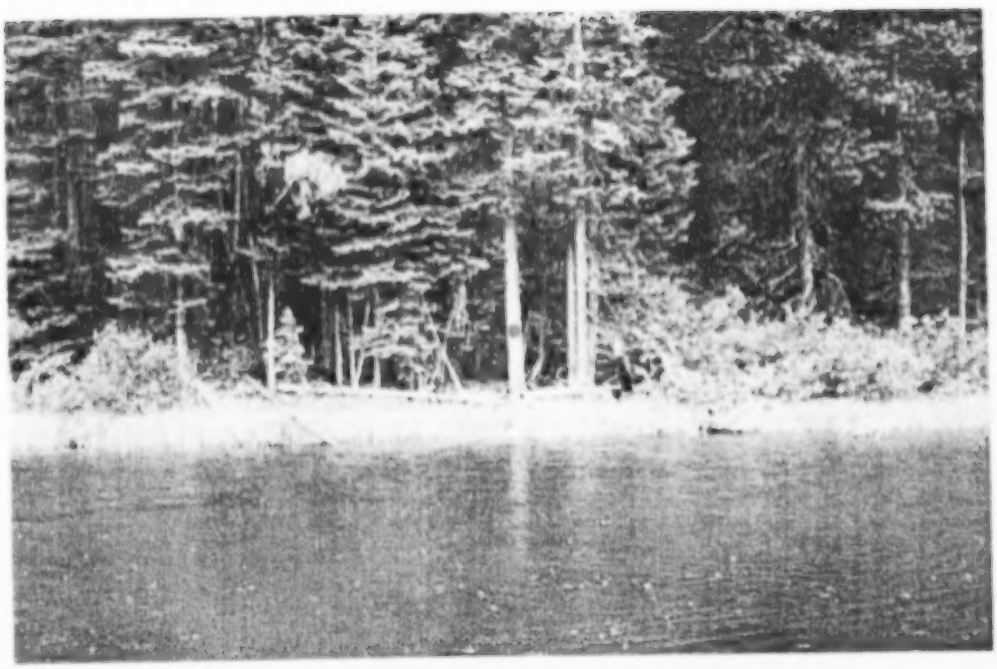


**Plate # 3:** View of the benchmark located 2.0 m above present water level in a 26 cm diameter spruce tree that is 2.72 m from the present water's edge and located on the northeast side of the lake directly opposite from a large boulder that is approximately 150 m east of Inlet # 3.

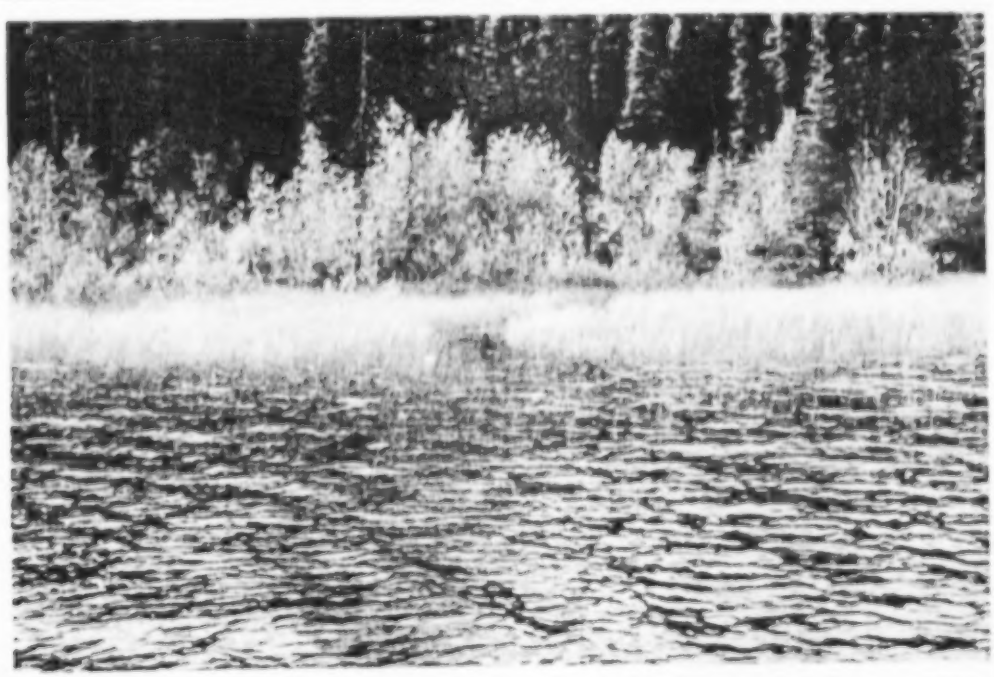


**Plate** # 4: View of the mouth of Inlet # 1 where it enters Unnamed Lake (Apostrophe Lake) in the northwest corner of the lake.

**LAKE: Unnamed Lake (Apostrophe Lake)**

**Plate # 5:** Upstream view of the sample site on Inlet # 1, taken approximately 150 m upstream of Unnamed Lake (Apostrophe Lake).

**Plate # 6:** Downstream view of the sample site on Inlet # 1, taken approximately 170 m upstream of Unnamed Lake (Apostrophe Lake).

**Plate** # 7: View of the mouth of Inlet # 3 where it enters Unnamed Lake (Apostrophe Lake) in the northeast corner of the lake.

**LAKE: Unnamed Lake (Apostrophe Lake)**

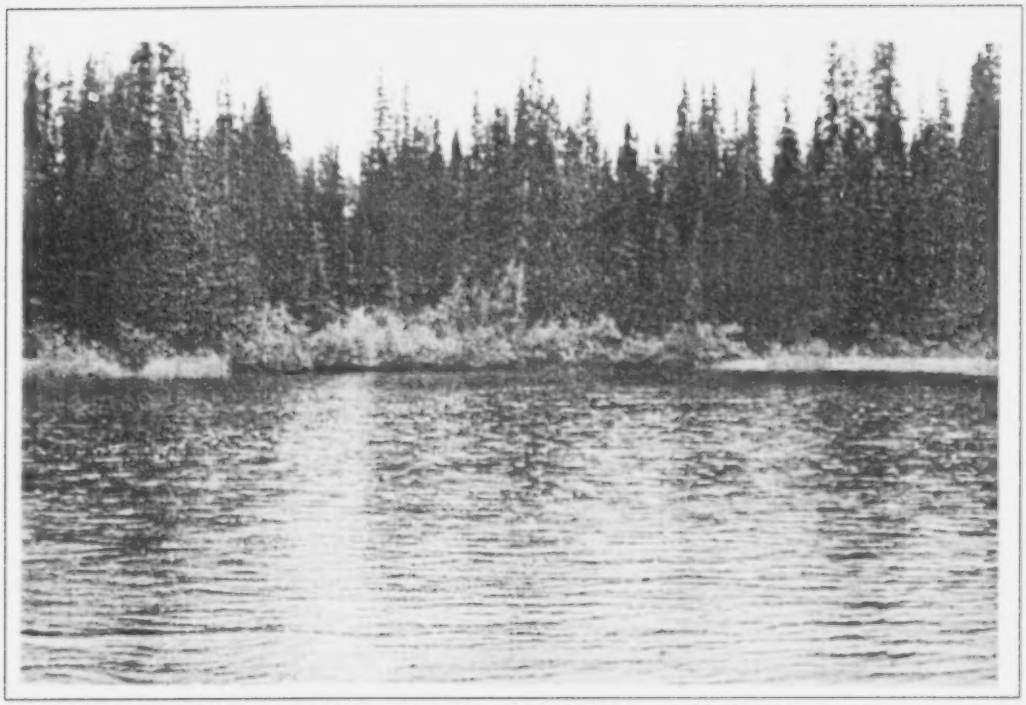


**Plate # 8:** View of the mouth of the outlet where it drains Unnamed Lake (Apostrophe Lake) from the south end of the lake.

**Plate # 9:** Upstream view of beaver dam # I on the outlet, located at the lake's edge. Dam height is 1.15 m.

LAKE: Unnamed Lake (Apostrophe Lake)

**Plate # 10:** Upstream view of the sample site # 1 on the outlet, taken approximately 95 m downstream of Unnamed Lake (Apostrophe Lake).

**LAKE: Unnamed Lake (Apostrophe Lake)**

**Plate # 11:** Downstream view of the sample site # 1 on the outlet, taken approximately 75 m downstream of Unnamed Lake (Apostrophe Lake).

**Plate #** 12: Upstream view of sample site # 2 on the outlet, taken approximately 145 m downstream of Unnamed Lake (Apostrophe Lake).

**Plate # 13:** Downstream view of sample site # 2 on the outlet, taken approximately 135 m downstream of Unnamed Lake (Apostrophe Lake).

# Appendix A

## LABORATORY REPORT

## Water Chemistry Analysis

RESULTS FOR UNNAMED LAKE #2 - 96/07/19 SAMPLES

| Parameter Analyzed | | Units | E223179 0.5M 963116-001 | E223179 4.5M 963116-002 |
|---|---|---|---|---|
| ALKALINITY | | mg/l | 110 | 110 |
| CONDUCTIVITY | | uS/cm | 199 | 199 |
| METALS/TOTAL (WATER-ICP) | AG | mg/l | <.01 | - |
| | AL | mg/l | <.06 | - |
| | AS | mg/l | <.06 | - |
| | B | mg/l | <.01 | - |
| | BA | mg/l | .072 | - |
| | BE | mg/l | <.001 | - |
| | CA | mg/l | 30.5 | - |
| | CD | mg/l | <.006 | - |
| | CO | mg/l | <.006 | - |
| | CR | mg/l | <.006 | - |
| | CU | mg/l | <.006 | - |
| | FE | mg/l | .029 | - |
| | K | mg/l | .2 | - |
| | MG | mg/l | 7.5 | - |
| | MN | mg/l | .007 | - |
| | MO | mg/l | <.01 | - |
| | NA | mg/l | .7 | - |
| | NI | mg/l | <.02 | - |
| | P | mg/l | <.1 | - |
| | PB | mg/l | <.06 | - |
| | SB | mg/l | <.06 | - |
| | SE | mg/l | <.06 | - |
| | SI | mg/l | 2.5 | - |
| | SN | mg/l | <.06 | - |
| | SR | mg/l | .049 | - |
| | TI | mg/l | <.002 | - |
| | V | mg/l | <.01 | - |
| | ZN | mg/l | .008 | - |
| NITROGEN/AMMONIA | | mg/l | .008 | .009 |
| /NITRITE+NITRATE | | mg/l | .005 | .003 |
| /TOTAL | | mg/l | .26 | .23 |
| PH | | Rel.U. | 8.26 | 8.27 |
| PHOSPHORUS/O-PO4 | | mg/l | .001 | <.001 |
| /TOTAL | | mg/l | .01 | .011 |
| /TOTAL DISSOLVED | | mg/l | .005 | .003 |
| RESIDUE/FILTERABLE | | mg/l | 120 | 120 |
| /NON-FILTERABLE | | mg/l | <5 | <5 |

## Appendix B

## Tributary Stream Data

## D.F.O. / M.O.E. Stream Survey Form

# DFO / MOE
## STREAM SURVEY FORM

Stream Name: Ingest Diamond Cr. — Locat: Forest Rd #1 to Diamond Lk #2 — Access: 3 — Method:
Watershed Code: — Length (km): 1 — Gradient: 20
Location: ~1.5 km U/S of Diamond Lk #5 — Map: 93-N/6 — UTM: — Zone: (N) — E: — N:
Date (YY/MM/DD): 96/07/18 — Time: 1255 — Activity: — Photos: — Air Photos:

| C | PARAMETER | VALUE | METH | SPECIFIC DATA | | | | STATION DATA C | Type | Loc n |
|---|---|---|---|---|---|---|---|---|---|---|
| | Ave. Chan. Width (m) | 2.0 | ST | 1.7 | 1.3 | 2.7 | 2.8 | | | |
| | Ave. Wet Width (m) | 1.5 | ST | 1.5 | 1.2 | 2.4 | 1.4 | | | |
| | Ave Max Riffle Depth (cm) | 20 | cm | 17 | 21 | 14 | | | | |
| | Ave Max Pool Depth (cm) | 30 | cm | 30 | | | | | | |
| | Gradient % | 5 | SC | | | | | | | |
| | Aspect | 045 | CE | | | | | | | |
| | Side Chan % | | SE | | | | | | | |
| | Debris Wood % | | CE | | | | | | | |
| | Debris Slash % | | | | | | | | | |
| | Stable % | 20 | E | | | | | | | |
| | COVER Total % | 20 | C | | | | | | | |
| | Comp Sum 100% | 5 | | | | | | | | |
| | Conif | 10 | | | | | | | | |
| | Decid | 5 | | | | | | | | |
| | Shrub | 5 | | | | | | | | |
| | Grass/Herb | | | | | | | | | |
| | Moss/Lich | | | | | | | | | |
| | Open % | 5 | E | | | | | | | |

BEDMATERIAL %: Clay silt sand (<2 mm) 40; Small 2-16 mm 30; Large 16-64 mm 15; Sm cobble 64-128 mm 10; Lge cobble 128-256 mm 5; Boulder >256 mm 0; Bedrock 0

$D_{50}$ cm: 2.5 — C — Compaction: L (M) H

BANKS: 1 — Height (m): 0.1 — Substrate: 20 — Texture: (F) G L B

Confinement: EN CO FC (DC) UC N/A — Valley Channel Ratio: 0-2 2-5 5-10 (10) N/A — Flood: Dry L M (H)

Stream Gauge (m³/s): 1.35 — Depth (cm): — Velocity: (FT) N — Width (m): 5 — cm — Discharge: — Water temp (°C): 11 — Temp (cm): — Cond (25°C):

DISCHARGE — Color or ___ cm

| Parameter | Value | Method | Specific Data | | |
|---|---|---|---|---|---|
| Wetted Width (m) | 1.5 | ST | 1.6 | 1.4 | |
| Mean Depth (m) | 0.2 | 2M | 0.28 | 0.24 | OE: |
| Mean Velocity (m/s) | 2.4 | FTM | 5.4, 5.9, 6.1 | | |
| Discharge (m³/s) | 0.65 | FTM | | | |

REACH SYMBOL (Right)

Width Ratio: Channel Slope: Bed Material:

FISH SUMMARY

| C | Species | No | Size Range (mm) | Life Phase | Use | Method/Ref. |
|---|---|---|---|---|---|---|
| | | | | | | |

STREAM/VALLEY CROSS-SECTION — Looking Downstream — L — R

PLANIMETRIC VIEW

COMMENTS

Channel Stability ___ Debris ___ Management Concerns ___ Obstructions ___ Riparian Zone ___ Valley Wall Processes ___ Etc.

1

Data Input:

Date Input:

# DFO / MOE
## STREAM SURVEY FORM

Stream Name: Unnamed Ck — Local: Outlet to Unnamed Lk #2 — Access: — Method: —

Watershed Code: — — —

# DFO / MOE
## STREAM SURVEY FORM

Stream Name: Unnamed Ck. (local: ~~Elliot~~ to Unnamed Ck #2) Access: Method:
Watershed Code:
Location: ~135m D/S of Unnamed Ck #2 UTM: 93-A/3 Length: 2 Width: 20
Date: DM D: 26 07 12 Time: 1030 Observers: MH KM Photos: Air Photos:

| C | PARAMETER | VALUE | METH | SPECIFIC DATA |
|---|---|---|---|---|
| | Ave. Chan. Width (m) | 2.0 | ST | 1.6 2.4 2.6 |
| | Ave. Wet. Width (m) | 2.0 | ST | 1.3 1.9 2.2 |
| | Ave Max Riffle Depth (cm) | 20 | am | 20 23 16 |
| | Ave Max Pool Depth (cm) | 40 | am | 38 |
| | Gradient % | 4 | SC | |
| 1 | Riffle 50 Rapid 0 Cascade 5 | | GE | |
| | Side Chan % | | GE | |
| | Dry Area % | | GE | |
| | Stable % | 40 | GE | |
| | COVER: Total % | 20 | GE | |
| 2 | Comp Sum 100% 15 | Ly Rck 15 | Lwd 30 | Boulder 0 Veg 30 Undercut 50 |
| | Crown Closure % | 55 | E | Aspect E |

BED MATERIAL: Fines (clay, silt, sand <2mm) 40; Gravels (small 2-16mm, large 16-64mm, sm cobble 64-128mm) 10; Cobble (lge cobble 128-256mm) 30; Boulder (>256mm) 10; Large 5; Bedrock (IN) 5; $D_{50}$ cm 10 C Consolidation L M H

BANKS: Height (m) 0.1 Substrate 35; Texture T S L R
Confinement: EN CO (FC) OC UC N/A
Valley Channel Ratio: 0-2 2-5 (5-10) 10+ N/A
Flood: Dry L M (H) Flood
Flood Signs (m): 0.50 Bankfull Y (N)
Stage (m): 0 Left Right
Water Temp °C: 14 Lab (cm) Cond (25°C)

DISCHARGE

| Parameter | value | Method | Specific Data |
|---|---|---|---|
| Wetted Width (m) | 1.5 | ST | 1.7, 1.45, 1.6 |
| Mean Depth (m) | 0.1 | Dm | 0.18, 0.17, 0.17, 0.13, 0.07 |
| Mean Velocity (m/s) | 1.2 | FSM | 5.9, 4.5, = 4.6 |
| Discharge (m³/s) | 0.14 | FSM | |

REACH SYMBOL
Plan:
Profile: Valley Channel Type: Bed Material:

Observations: C Type Loc n

FISH SUMMARY

| C | Species | No | Size Range cm | Life Phase | Use | Method/Ref |
|---|---|---|---|---|---|---|
| | | | | | | |

STREAM/VALLEY CROSS-SECTION (Looking Downstream) L R
PLANIMETRIC VIEW

COMMENTS
Channel Stability Debris Management Concerns Obstructions Riparian Zone Valley Wall Processes Etc

1 other is 2 cascade
2 additional cover provided by deep riffles (another 20%
3 water covered boulders w/ air space, or other hydrologic control (minimize 2% venturi

Edited by
Date

## Appendix C

## FISH SCALE ANALYSIS

**Age Determination Completed By:**

**A.M.C. Technical Services Ltd.**
**Melinda M. Hirst**
**6809 Phillip Road.**
**Lantzville, B.C.**
**VOR 2H0**

SEE ORIGINAL COPY

FOR SCALE SAMPLE READINGS

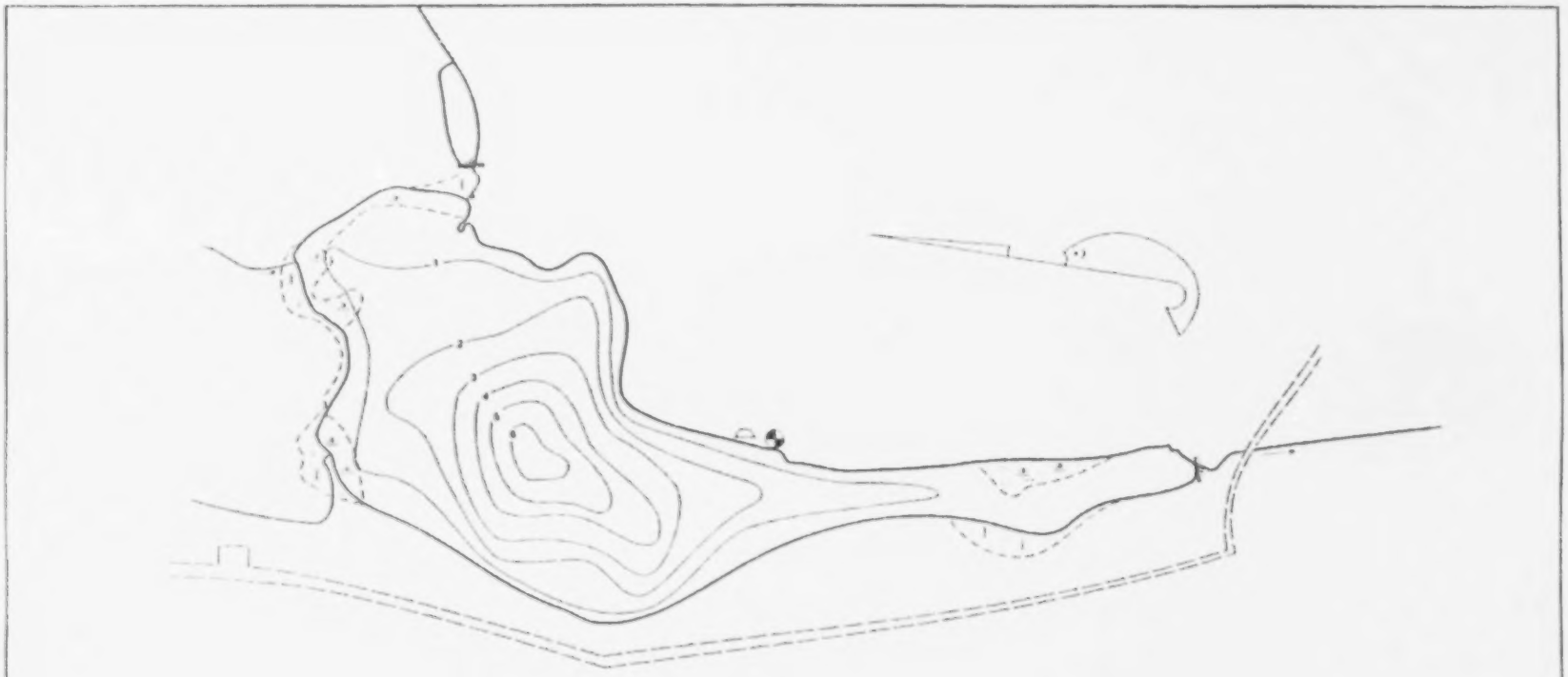
ORIGINAL COPY IS HELD BY

B. C. MINISTRY OF ENVIRONMENT, LANDS AND PARKS

PRINCE GEORGE, B. C.

# Appendix D

# BATHYMETRIC MAP



Reduced to
34%
of Original Size

STATISTICS AT TIME OF SURVEY

| | | |
|---|---|---|
| Elevation | 933 | m ? |
| Surface Area | 188969 | sq m |
| Area above bm xxxxxx | 188969 | sq m |
| Volume | 294162 | cu m |
| Mean Depth | 1.7 | m |
| Maximum Depth | 6.3 | m |
| Perimeter, Main Shore | 2632 | m |
| Perimeter, Islands | 0 | m |
| Bench Mark | 2.6 | m |

# Unnamed Lake
# (Apostrophe Lake)